THE
HYDROCARBONS
OF
THE MOFFAT ROAD.

THE

HYDROCARBON FIELD

OF

WESTERN COLORADO

AND

EASTERN UTAH

ON THE

PROJECTED LINE

OF THE

DENVER, NORTHWESTERN AND PACIFIC RAILWAY.

REPORT ON THE ABOVE TO MR. D. H. [illegible]
PRESIDENT, BY MR. W. WESTON, M. [illegible]
MINING ENGINEER.

[illegible]

NOVEMBER 1, 1907. [illegible]

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REPORT ON

THE HYDROCARBON DEPOSITS

ON THE PROJECTED LINE OF THE

DENVER, NORTHWESTERN AND PACIFIC RAILWAY.

By W. WESTON, M. I. M. M.
MINING ENGINEER.

To D. H. MOFFAT, ESQ.,
President, Denver, Northwestern and Pacific Ry.,
Majestic Building, Denver, Colorado.

INTRODUCTION.

DEAR SIR:—I have already made a full and detailed report to you on the Yampa Coal Field of Colorado, of one thousand square miles in extent, with an estimated thickness of seventy-five feet of workable coal, which field the Denver, Northwestern and Pacific Railway, popularly known as the Moffat Road, is destined to traverse.

Where the coals end, there the hydrocarbons may be said to begin, thus giving what might be termed a carbonaceous product and traffic for an uninterrupted distance of two hundred miles along the line of the road. The coal field really extends to Lily Park, Routt County, Colorado, though the analyses which I have so far had of the coals of the Lily Park region show that, while they are good domestic coals, for shipping or storing, and in their heating power, they are inferior to those of the region of Yampa and Craig, Colorado.

Petroleum, which is one of the hydrocarbons, has already been found in Raven Park, Rio Blanco County, Colorado, where there is opened a six-barrel per diem well of the finest quality of illuminating oil.

AREA AND TONNAGE OF HYDROCARBONS.

At the state line of Colorado and Utah, the bituminous or asphaltite deposits begin, and extend westward to Ft. Duchesne and Pariette, Utah, and then on to the elaterite deposits of Indian, Lake and Sams Canons, fifty miles southwest of Ft. Duchesne, the total hydrocarbon area being estimated at about ten thousand square miles, and the tonnage, or probable yield, of the five gilsonite veins, the Cowboy, Black Dragon, Bonanza, Culmer and Duchesne, and including the Middle Park, Colorado, vein, at thirty-two millions of tons. This is exclusive of the elaterite veins, the bituminous limestones, and the sandstone asphaltum deposits.

VALUE OF HYDROCARBONS.

As the value of the Utah gilsonite is between $40.00 and $45.00 per ton, and the elaterite $65.00 per ton, it is marvellous how little is known or understood of the enormous riches of this undeveloped region.

NOMENCLATURE.

The term, hydrocarbon, has been used to designate all compounds containing only hydrogen and carbon. Those with which we have to deal are chiefly gilsonite, elaterite and petroleum.

Gilsonite is also known as Uintaite, and may be described as the purest form of crude bitumen. It is also spoken of as asphaltum, and mineral pitch, and I give all the names which are used, to prevent misunderstanding.

Elaterite is also spoken of as mineral rubber, and to simplify matters, I have used the term, elaterite, as that is the name by which the product of the Indian Canon district is locally and generally known, though Mr. Geo. H. Eldridge, in his chapters on the asphalt and bituminous rock deposits of the United States, in the twenty-second annual report of the United States Geological Survey, designates it as Wurtzilite, and classes elaterite and Wurtzilite as two distinct members of the hydrocarbon family.

So now, in order to avoid confusion, and for the pur-

poses of this report, I shall use only the terms gilsonite and elaterite.

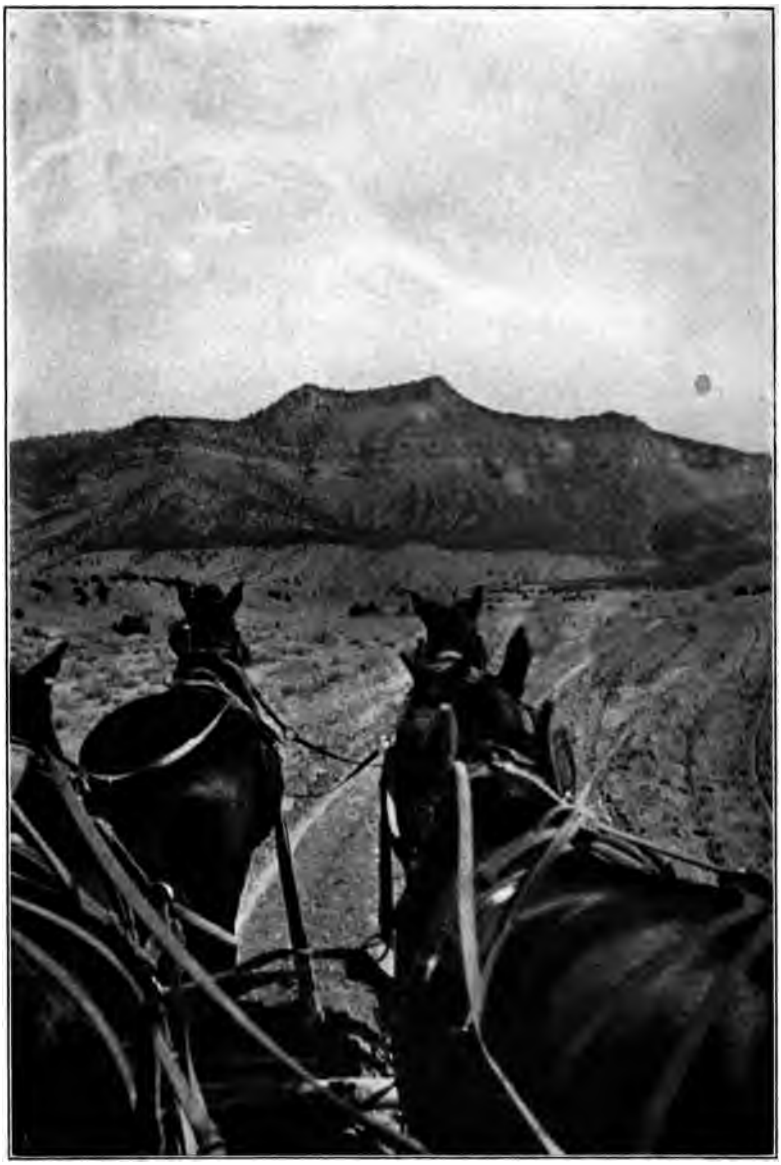
Ozocerite, known as mineral wax, also belongs to the natural hydrocarbons, and is found near Soldier Summit, in Utah.

Besides these already enumerated there is the vast deposit of sandstone asphaltum about four miles west of Vernal, Utah, in the Ashley Valley, or rather on the hills which divide the Ashley from the Uintah Valley; also the asphaltic limestones of Indian and Lake Canons.

LOCATION OF HYDROCARBON FIELD.

The chief hydrocarbon field of the Moffat Road is in what is known as the Uintah Basin, Utah, which is bounded on the north by the great Uintah Range, with a length of about one hundred and fifty miles, a width of sixty miles, and whose peaks rise to altitudes of nearly fourteen thousand feet; on the west by a north and south spur of the Uintah Range; on the south by the Book Cliffs, otherwise known as the Roan Plateau, which for upwards of two hundred miles on the south face present a line of almost unbroken cliffs, two to three thousand feet in average height above their base, the photo on page 6 giving some idea of these sandstone bluffs; and on the east by the Yampa Plateau and the Danforth Hills, forming a basin about one hundred and seventy miles in length, by one hundred miles in width. It may be said to be situate about half way between the Union Pacific Railroad on the north and the Rio Grande Western Railway on the south, and separated from the former by the Uintah Range, and from the latter by the Book Cliffs, a distance of over one hundred miles each way. The general elevation of the Uintah Basin is from five to six thousand feet.

At present all the hydrocarbons shipped, and the supplies brought in, have been by a wagon haul of one hundred and twenty miles. There is a daily stage from Price, Utah, on the Rio Grande Western, to Vernal, Utah, passing through Ft. Duchesne, a distance of one hundred and twenty miles, and occupying two days' time. The south-



BOOK CLIFFS, TEN MILES NORTH OF PRICE, UTAH.

eastern gilsonite veins, the Cowboy, Black Dragon and Bonanza, are reached from Rifle, Colorado, on the Denver & Rio Grande Railway, a distance of one hundred and twenty-two miles.

GEOLOGY.

The whole of the formation in the Uintah Basin is sedimentary—the sandstones, shales and limestones of the Eocene-Tertiary period. (See page 8.)

VALUE FROM AN INDUSTRIAL STANDPOINT.

Having given the location, and probable extent of the area, in which are found the solid hydrocarbons, I will endeavor to give some idea of their value from an industrial standpoint.

Their origin is largely conjectural, but as with the coals, I imagine the chief points on which you desire information are quality, value and tonnage, hence I shall confine myself largely to these points.

COMMERCIAL USES.

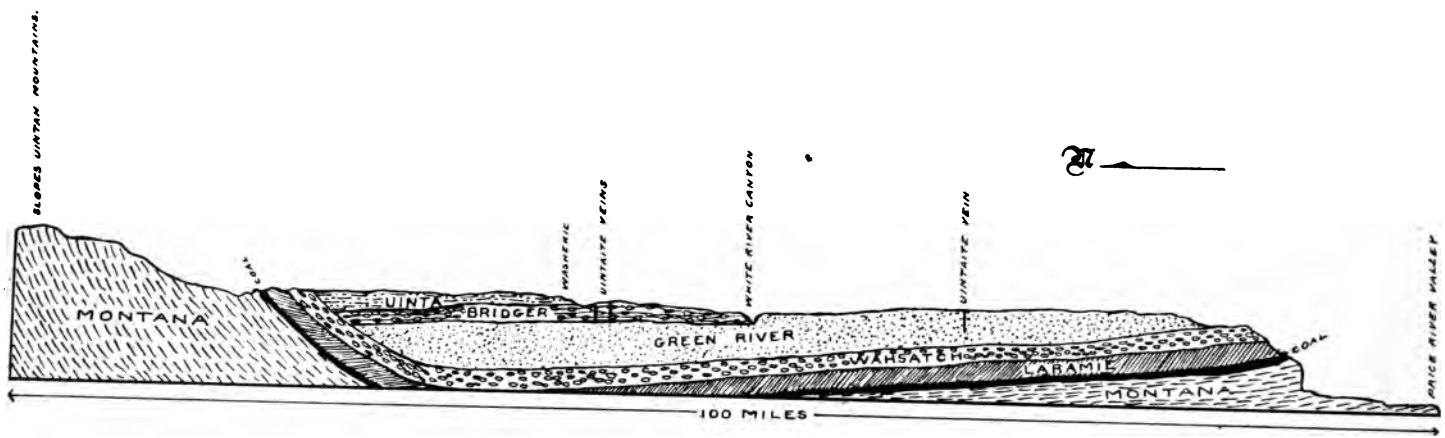
The uses to which gilsonite and elaterite are put are so varied, and so little has been written on the subject, that it is hard to get these details perfect, but I will give such as I have at my command.

MINERAL RUBBER.

To begin with, it has long been known that there is a big shortage in the world's supply of vegetable rubber, with the consumption increasing at the rate of fifty per cent. in the last five years, and apparently no possible increase in the production of tree rubber. The estimated manufactured rubber business of the United States in 1899 was $161,789,000, and exclusive of British and foreign business. It is now stated on good authority that these hydrocarbons are being manufactured into a mineral rubber, which unites perfectly with the tree rubber, thus permitting a very large reduction in the amount of the latter used, and cheapening its cost very materially.

PAVING CEMENT.

Second grade gilsonite is used in the manufacture of



CROSS SECTION OF THE UINTAH BASIN.

AFTER ELDRIDGE

paving cement, by melting it with petroleum residue, and mixing it with ground asphaltic limestone, and the requisite amount of sand.

PAINTS AND VARNISHES.

Gilsonite is also successfully manufactured into varnishes, lacquers, waterproof paint for guns, gun carriages, and steel and woodwork of every description known to shipbuilding. I have also been informed that when manufactured into a paint for ships' bottoms, it prevents barnacles from attaching themselves, and that it is likely to be largely used for this purpose for battleships. It is also used for pipe coatings, reservoir coatings, floorings, roofings and railroad coatings. I copy the following list of uses from a statement by Mr. W. E. Parker, in "Mineral Resources of the United States for 1893":

OTHER USES.

For preventing electrolytic action on iron plates of ships' bottoms;
Coating barbed wire fencing;
Coating sea-walls of brick and masonry;
Coating paving brick;
Acid-proof lining for chemical tanks;
Roofing pitch;
Insulating electric wires;
Smokestack paint;
Coating poles, posts and ties;
Lubricant for heavy machinery;
Toredo-proof pile coating;
Covering wood-block paving;
Binder pitch for culm in making eggette and briquette coal.

USES FOR ELATERITE.

The elaterite is being largely used now to make flexible and heat-proof varnish or paints, and it is said of these paints that owing to their great resistance to acids, alkalies, fumes and vapor attacks, and to their elasticity for contraction and expansion, they are invaluable for coating shaft and tunnel timbers, for painting hemp and wire hoisting

ropes, pump columns, pipes, chains, ore cars and all steel and ironwork where the surfaces are exposed. Also for coating vats, tanks and pan covers used in chlorination works, smelters and refineries, and in the cyanide process. On ironwork it prevents corrosion, and resists great heats. On woodwork it prevents absorption and defies the elements. But for their flexibility, the elaterite paints and varnishes are the best by very long odds.

Such are some of the uses only, to which gilsonite and elaterite are being put now, while others are being constantly discovered, of which as yet I have no record.

HOW OWNERSHIP WAS OBTAINED AND ACT OF CONGRESS RELATING THERETO.

I have found it extremely difficult to get at facts and details, but as I have "boiled it down," it appears to me that the pick of the gilsonite veins or deposits of Eastern Utah are owned by, first, The St. Louis Asphaltum Company, offices at Vernal, Utah. This company owns the greater proportion of the southeastern veins and the Duchesne vein. Second, The American Asphalt Association of St. Louis, Missouri, which owns one thousand feet on the Cowboy vein where it shows eighteen feet in width of gilsonite. Third, The Raven Mining Company, with headquarters in Chicago, and owning, according to a map which I have obtained from Washington, the best of the elaterite veins of the Indian and Lake Canons districts.

It may be asked: "When all these deposits are within the Uintah and Ute Indian Reservations today, and have been since 1891, how can this have been accomplished?"

To begin with the Cowboy, Bonanza and Black Dragon series of veins, these are in the Uncompahgre Ute Indian Reservation. By an act of Congress, signed by the president last March, it was enacted:

> "That in the lands within the former Uncompahgre Indian Reservation, in the state of Utah, containing gilsonite, asphaltum, elaterite and other like substances, which were reserved from location and entry by provision of the act of Congress entitled 'An act making appropriations for the current and contingent expenses of the Indian Department, and for fulfilling treaty

stipulations with various Indian tribes, for the fiscal year ending June thirtieth, eighteen hundred and ninety-eight, and for other purposes,' approved June seventh, eighteen hundred and ninety-seven, all discoveries and locations of any such mineral lands by qualified persons prior to January first, eighteen hundred and ninety-one, not previously discovered and located, who recorded notices of such discoveries and locations prior to January first, eighteen hundred and ninety-one, either in the state of Colorado, or in the office of the county recorder of Uintah County, Utah, shall have all the force and effect according to law to locations of mining claims upon the public domain. All such locations may hereafter be perfected, and patents shall be issued therefor upon compliance with the requirements of the mineral land laws, provided that the owners of such locations shall relocate their respective claims and record the same in the office of the county recorder of Uintah County, Utah, within ninety days after the passage of this act. All locations of any such mineral lands made and recorded on or subsequent to January first, eighteen hundred and ninety-one, are hereby declared null and void; and the remainder of the lands heretofore reserved as aforesaid because of the mineral substances contained in them, in so far as the same may be within even numbered sections, shall be sold and disposed of in tracts not exceeding forty acres, or a quarter of a quarter of a section, in such manner and upon such terms and with such restrictions as may be prescribed in a proclamation of the president of the United States issued for that purpose not less than one hundred and twenty days after the passage of this act, and not less than ninety days before the time of sale or disposal, and the balance of said lands and also all the mineral therein are hereby specifically reserved for future action of Congress."

I believe that The St. Louis Asphaltum Company and The American Asphalt Association claim that their holdings were located prior to 1891. The Duchesne vein, owned by The St. Louis Asphaltum Company, from which are

being shipped three hundred tons of gilsonite per month, I believe was not located prior to 1891, but what is known as the "four-mile strip," containing this great vein, was cut out of the Uncompahgre Reservation for the benefit of this company.

OWNERSHIP OF ELATERITE VEINS.

The elaterite deposits of Indian Canon are in the Uintah Indian Reservation. The act already referred to has the following clause:

> "That the time for opening the unallotted lands to public entry on said Uintah Indian reservation, as provided by the act of May 27, 1902, be and the same is hereby extended to October 1, 1904."

But it appears that The Raven Mining Company got permission from the government to locate one hundred claims prior to the opening of the reservation in 1904.

This latter company is mining and shipping elaterite now under a lease obtained from the Indians. I am informed that in 1893 Judge McConnell, of Salt Lake City, and now of The Raven Mining Company, secured this lease through Major Myton, then Indian Agent, and the same was approved by the Secretary of the Interior, and about the same time the said McConnell, through Major Myton, secured a permit to prospect and locate six hundred and forty acres prior to the opening of the reservation lands to public entry in October, 1904, and the same was approved by an act of Congress.

The map which shows the holdings of The Raven Mining Company in Sams, Indian and Lake Canons was filed with the Department of the Interior, with W. A. Jones, Commissioner of Indian Affairs, by Chas. J. Phister, President of The Raven Mining Company, in November, 1900. It is entitled:

> "Diagram showing the location of the hydrocarbon deposits discovered and located by The Raven Mining Company on the Uintah Indian Reservation, under its lease approved November 26, 1898."

PRESENT SHIPMENTS.

The latest information (November 16) I have from a

friend at Vernal, Utah, is to the effect that The St. Louis Asphaltum Company is shipping about four hundred tons of gilsonite per month from the Duchesne vein, by wagon to the railway at Price, Utah, one hundred miles, at $13.00 per ton haulage.

The American Asphalt Association is shipping three hundred tons of gilsonite per month by wagon to the Denver & Rio Grande Railway at Rifle, Colorado, the distance being one hundred and twenty miles; hauling charges, $22.00 per ton.

The Pariette Company, operating on the Culmer vein southwest of Duchesne bridge, is said to be shipping two hundred tons per month to Price, Utah.

The Raven Company is shipping two hundred and twenty-five tons of elaterite per month to the Rio Grande Western Railway at Jennings Spur, Utah.

The value of these shipments amounts to about $56,000 per month.

QUOTATIONS AND COST OF PRODUCTION.

Through a friend who is in the business of hydrocarbon manufacturing in Denver, I obtained today (November 22) actual quotations. The Raven Mining Company quotes elaterite at $65.00 per ton f. o. b. in Utah. The American Asphalt Association quotes gilsonite at $41.00 per ton f. o. b. Denver.

When I examined the Duchesne vein last April, $13.00 per ton wagon freight to Price, Utah, was being paid, and $5.50 railroad freight in addition to St. Louis.

The superintendent informed me that the cost of mining and sacking would not exceed $3.00 per ton, or a total for production and transportation of $21.00 per ton.

The shipments from the Cowboy series, near the Colorado line, cost $22.00 per ton wagon haulage to Rifle, Colorado, but as the vein is eighteen feet in width, and not so deep, it could be mined cheaper than the three foot Duchesne vein, and I should estimate the cost of putting this on the market at about $26.00 per ton.

So that, even with the present crude methods of mining, and long wagon haul, there is a clean profit on the gilsonite of from $15.00 to $20.00 per ton.

The elaterite being in much narrower veins, costs more to mine, but then it is, comparatively speaking, close to the railroad, and the profits on this must be at least $45.00 per ton.

THE WILLOW CREEK GILSONITE VEIN, MIDDLE PARK, COLORADO.

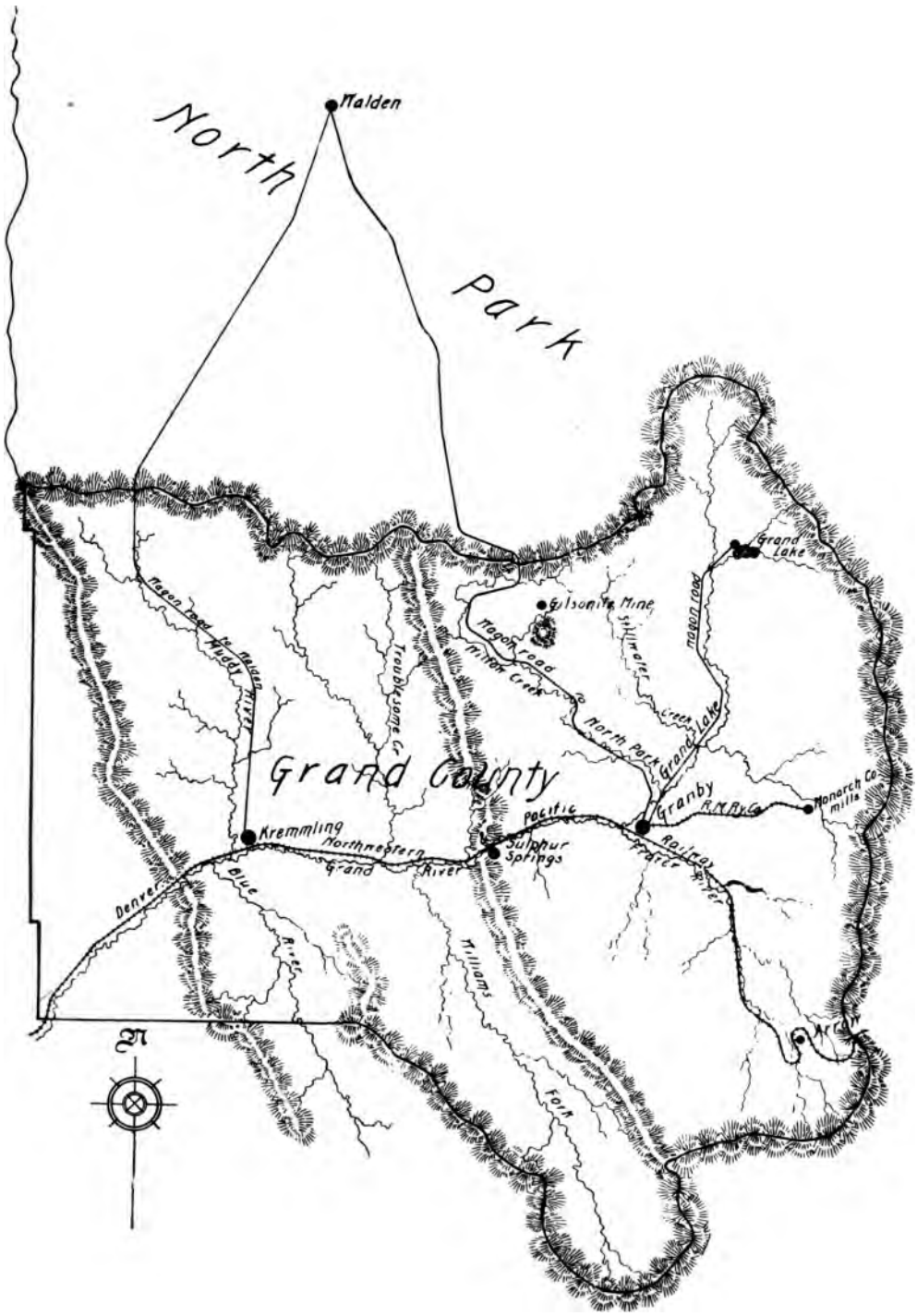
I made an examination of this property on March 10, 1903. It is located on Willow Creek, a tributary to the Grand River. It is reached at present by rail from Denver to Empire, then by stage from Empire to Hot Sulphur Springs, forty-five miles, and thence by stage to Dexter, twelve miles from Hot Sulphur Springs. From Dexter, in summer, one can follow Willow Creek on water grade to within half a mile of the mine, twenty-two miles, but being midwinter, the route I took was on snowshoes straight across from Dexter to the mine, over Gravel Mountain, which I crossed at an elevation of eleven thousand three hundred feet, and then down to the mine—elevation, ninety-five hundred feet—a total distance from Dexter of fifteen miles. Gravel Mountain is about the highest ridge between Middle Park and North Park, and close to Cascade Mountain, of the Rabbit Ear Range, which divides North and Middle Parks.

NAMES OF CLAIMS.

The gilsonite property has been located as placers, these being known first as the Hill Top, Black Queen and Asphaltum King, these being the names given by the first owners, The Colorado Gilsonite Company, and later as Spring, Summer, Autumn and Winter, the names given by the present owners, The American Asphaltum Company.

DESCRIPTION OF THE VEINS.

The vein of gilsonite has a north and south course, and dips about eighty-five degrees to the west, or out of the hill. The outcrop has its course along the slope of the hill on the east side of Sherman Creek, which empties into Willow Creek about half a mile down the gulch. The vein is opened by a crosscut tunnel from Sherman Creek gulch, whence it is driven in an easterly direction, and intersects


North
Park
Walden
Grand Lake
Gilsonite Mine
Grand County
Kremmling
Sulphur Springs
Granby
Monarch Co mills
Pacific
Northwestern
Grand River
Denver
Blue River
Troublesome Cr.
Williams Fork
N

the vein at a distance of one hundred and sixty-six feet into the hill. Just beyond this intersection, an east and west vein of gilsonite was encountered, but it is apparently only a branch or feeder of the main north and south vein. The largest body of gilsonite, however, is at this point of intersection of the two veins, and is in one place about fifteen feet thick, but I should put the average width at about four feet. The workings are not sufficiently extensive, however, to demonstrate the extent and probable permanence of the vein. It is apparently a vertical fissure in a sandstone country rock, which fissure has been filled from below with this mineral pitch, and though little can be predicted with regard to its permanence with depth, it does not seem probable that it will decrease in size and value as its source is approached. A winze has been sunk below the tunnel level about nine feet, but water came in, and sinking had to be stopped.

The vein is said to be traceable on the surface for three thousand feet, but the only place where any large body of gilsonite appears on the surface is at a point above the present workings.

The mountain on which the claims are located is covered with a dense growth of very fine timber—spruce, balsam and white pine. Sherman Creek flows past the dump, and with a good wagon road to the railway, and a proper equipment of machinery, the mine has every facility for cheap working.

ORE SHIPPED AND IN RESERVE.

The gilsonite appears to be very uniform in its character, and very free from any foreign substances in the vein, and the resident owner informed me that he had tried to sort it by picking out the brightest and best-looking of the product, but it made no difference, as the tests showed that the quality was uniform. He also informed me that about fifteen hundred tons had been shipped, the greater part of which was taken from the surface. He had about one hundred tons in the bins, and about one thousand tons practically in reserve between the tunnel level and the surface, though this was not actually blocked out, but could probably be extracted from the present workings.

The workings are all done in ore, *i. e.*, the drifts are driven in the mineral, which is all picking work, a small, light coal miner's pick being used. The gilsonite crumbles up very fine in the course of extraction, and being perfectly free from admixture with rock or foreign substances, is sacked in burlap or sugar sacks as it comes from the vein, each sack holding about one hundred pounds of gilsonite. With the seam well opened up for stoping, one man can take down ten to twelve tons a day with ease.

COURSE OF VEIN AND DEPTH GAINED.

Going south, the vein has its course along the ridge towards Gravel Mountain, its highest point, and if continuous to that point, which it appears to be from surface indications, according to the owners' information, it would gain a depth of two thousand feet below the surface in a distance of about two and one-quarter miles. Owing to the snow, however, I was unable to see any of the surface during my examination.

COST OF PRODUCTION.

I went over the question of the cost of production, and getting the product to market, with the superintendent in charge, and we estimated as follows:

Cost of mining, including sacking ready for shipment	$ 3.25
With a good wagon road to the railway, a four-horse team should haul 7,500 pounds in two days, and this would therefore cost, per ton	5.00
Railroad freight to Denver, say	1.75
	$10.00

The above reckoning of cost for mining only applies to workings above the tunnel level, as with sinking, hoisting the mineral, and having to handle water, the cost would be increased as depth was gained.

WAGON ROAD TO RAILWAY.

Regarding the wagon road to be built, there are two feasible routes, one to connect with the road from Grand Lake to Coulter, but this would have a lot of swampy

ground and a bad and difficult divide to cross; the other, by Willow Creek, the whole way on a good water grade, to Dexter. There is already a tolerably good road by this latter route, and $2,500.00 spent in bridges across the creek, and a little improving of the roadbed, would render it fit for all ore-hauling purposes.

VALUE OF THE PROPERTY.

As regards the value of the Willow Creek gilsonite property, and its probable output, at present the geological occurrence of this form of hydrocarbon seems to be imperfectly known, and so few examples have been furnished, or precedents established by the result of extensive and deep workings in places where it occurs, that it is impossible to predict with any degree of certainty as to its permanence in depth, and along its course, of this vein or body of asphaltum. For the value of the property, therefore, and the extent of its future production, I should recommend that reliance be placed solely on the result of actual exploitation and blocking out of reserves.

ANALYSIS.

An analysis of my sample of this Colorado gilsonite gave the following result:

Moisture	1.00
Volatile Matter	35.50
Fixed Carbon	59.00
Ash	4.50

Specific gravity, 1.145.
Insoluble in alcohol.
Partially soluble in turpentine and carbon disulphide.
Ash, dark brown.
Fixed carbon, coking, spongy.

OTHER VEINS OF THIS REGION.

Other veins of gilsonite have been discovered in this section, one on Stillwater Creek, and another not far from the head of Gold Run Creek, but only assessment work has been done, as none of it will pay to ship, and with the present

long haul to the railway, there is no incentive to development. But with the Moffat Road at Windy Gap, it should be mined and delivered in Denver at a cost of about $10.00 per ton, giving a profit of $30.00 per ton at the present market price. This is based on the estimated average width of four feet for the Willow Creek vein, but the probability is that other, and judging from the outcrops, much narrower veins, will be discovered and worked, and I think therefore that an average cost of $15.00 per ton would be a very liberal estimate of the cost of putting this Middle Park gilsonite on the Denver market.

THE FT. DUCHESNE VEIN.

I examined this vein in April last, travelling by rail to Price, Utah, and thence by stage to Ft. Duchesne. The mine is about two and one-half miles east of the fort, and is equipped with a boarding-house and store, but there are no mine buildings, as the vein is worked by an open trench, half a mile long, and ninety feet deep, *i. e.*, the vein has been underhand stoped from the surface to this depth. Working underground with naked lights was tried, but an explosion of the gilsonite dust in suspension in the air killed two men, and blew a hole through to the surface. By the present method they have daylight to mine by. The gilsonite is simply broken with a light miner's pick, and sent to the surface by a horse whip, when it is sacked, and sent to market as already detailed.

DESCRIPTION OF THE VEIN.

The vein, as shown in the workings, averaged three feet in width of pure gilsonite, no country rock or foreign matter being mixed with it, although, according to a description by Mr. George H. Eldridge, in the Annual Report of the United States Geological Survey for the years 1900 and 1901, it is stated that at the northern end, near the surface, fragments of the country rock were enclosed in the gilsonite. The walls of the vein are sandstone, and the vein is vertical, its strike being north forty degrees west.

When mined near the surface, the gilsonite was divided into first and second grade, but as depth was gained, the second class disappeared, and now only the first quality is

produced. Three hundred tons per month were being shipped at the time of my visit, and the superintendent told me the gilsonite realized $50.00 per ton in St. Louis.

The property is owned by The St. Louis Asphaltum Company, and is said to have been operated during the past nine or ten years.

The methods of mining seem very crude, and I should judge, with the advent of the Moffat Road, proper machinery for hoisting, ventilating and lighting by electricity will be put in, and the mine will be worked to a greater extent.

The lighting of the mine seems rather a difficult problem, as the gilsonite dust softens on the glass of a lamp, forming a sticky film. It does the same on the skins of the miners, and they told me they used naphtha to get it off their hands and faces when they quit work for the day. It also penetrates the lungs.

Since writing the foregoing, and just before going to press, I am told that the company has put in a small electric plant, and that the workings are now lighted in this manner.

For fuel, coal could be obtained from the banks seven miles northwest of Vernal, which is a fine domestic coal, with a seam from four to six feet in thickness. At present this coal is probably too far distant (about twenty-three miles) for economical use, but with a railway through the valley, this coal, or coals from the Yampa field, of Routt County, would become available.

Water for the boilers would have to be pumped from the Uintah River at Ft. Duchesne, unless artesian well-boring at the mine prove successful.

I could see the outcrop of this vein for fully two miles, but Mr. Eldridge, in his report, says it is traceable for three miles, and that "a width of from three to four feet is maintained for a length of about one and one-quarter miles along the middle of the outcrop, but beyond this, in either direction, it gradually diminishes to complete disappearance."

The photograph on the following page, which I took on my visit, gives a very fair idea of the method of working, and the general character of the surrounding country; the

WORKINGS ON DUCHESNE GILSONITE VEIN, UTAH.

GILSONITE SACKED FOR SHIPMENT TO ST. LOUIS.

barbed-wire fence on each side of the open cut is to prevent cattle from falling into the workings.

The photograph on page 22 shows the gilsonite sacked ready for shipment to St. Louis, and the horse "whip" with which it is brought to the surface.

I brought out samples of this gilsonite, which are now in the basement of your offices, along with the exhibit of coals.

As I was unable to visit them last April, for the Pariette mine, and the Cowboy, Black Dragon, and Bonanza series, near the Colorado line, south of Vernal, I have drawn on the descriptions by Mr. Geo. H. Eldridge, in his official report already referred to.

THE PARIETTE COMPANY'S VEIN.

The Culmer vein of The Pariette Company, situate about twenty miles south of Ft. Duchesne, resembles the Duchesne vein in general character. It can be traced across the plain for seven miles, in which distance it varies in width from a knife-blade to thirty inches, a common width being eight or ten to sixteen inches. It has one lateral, however, traceable for over half a mile, clearly defined, and with a width of twelve to sixteen inches. There are many other laterals or branches. The course of the main vein is north thirty-five degrees west.

This vein and its laterals have been prospected at intervals for their entire length, and the main fissure, about midway, has been mined to a depth of two hundred feet, with stopes one hundred and fifty feet each way from the shaft. Near the surface, the vein has been removed, with interruptions, to depths of from forty to seventy-five feet for nearly half a mile, its width varying from three to thirty inches in these surface workings.

In view of the very large veins now being opened in the White River series, near the Colorado line, it is probable that these small veins will be unable to compete unless their shipping facilities should happen to be exceptionally favorable.

THE WHITE RIVER GILSONITE REGION.

The principal gilsonite veins of this region are located on the north side of the White River, near the mouth of

Evacuation Creek, these veins being the Cowboy and the two Bonanzas. The Black Dragon, next in importance, is about three miles south of the former, and on the south side of the White River. There are a large number of lesser veins, extending from the Cowboy and Bonanza veins as far westward as where the White River empties into the Green River, just south of the Ouray Agency, a total distance of about thirty miles.

DESCRIPTION OF THE VEINS.

Like the Duchesne, the Cowboy and the two Bonanzas are vertical fissures in a sandstone formation, their course being north fifty-five degrees west. The east Bonanza vein is distant from the Cowboy about two and one-half miles.

THE COWBOY VEIN.

As measured by a good mining man in my employ, whom I sent down there, the Cowboy vein of gilsonite is about sixteen feet in width for nearly three-quarters of a mile in length. But I will quote the exact words of Mr. Geo. H. Eldridge, in his report to the United States Geological Survey:

> "The Cowboy is the largest of the three veins in the White River region, a maximum width of eighteen feet having been observed at the crest of the ridge, two miles north of the river. In either direction from this point, it thins considerably, but maintains a width of eight to twelve feet for a distance of at least three or four miles, and about four feet for nearly six miles. Its total length is between seven and eight miles."

Mr. Eldridge estimates the available tonnage of the Cowboy vein at 14,069,250 tons, and let it be remembered here that in writing of the width of these "veins," we are writing of the width of gilsonite, as the content of them is gilsonite from wall to wall, and the values are not admixed with rock more or less barren between walls, as in metalliferous veins. It should also be borne in mind that there is no sorting to be done, and no metallurgical "nut to crack" in the selection of a proper process to treat the pro-

duct, as with metalliferous ores; here you simply take it out and sack it, and sell it—a simple banking proposition in fact, in which you write your cheque with a pick, and it is cashed on presentation of your product. It beats most gold mining all hollow, and truly wonderful as this vein is, with its contents rated at about fourteen millions of tons, and a gross value of $562,770,000, the evidence I have adduced will be sufficient, I think, to show that it is altogether worthy of credence.

THE BONANZA VEINS.

The Little, or West, Bonanza vein can be traced for seven miles, and shows on the average five feet in width for three miles, and four feet in width for one mile, the greatest width being thirteen feet. The Big, or East, Bonanza vein will average ten feet in width for three miles along its course.

Mr. Eldridge has estimated the available tonnage of these two veins at 15,518,884 tons, which, at $40.00 per ton, represents a gross value of $620,755,360.

THE BLACK DRAGON VEIN.

The Black Dragon vein is traceable for four miles, and will average six feet in width for two miles. It has two or three parallel fissures or veins from two to three feet apart, the average width of which are about two feet.

Mr. Eldridge estimates the available tonnage of the Black Dragon vein at 2,086,479 tons, which, at $40.00 per ton, would have a gross value of $83,459,160.

In all the above instances, the estimates of tonnage are Mr. Eldridge's, while those of values are my own.

OTHER VEINS OF THIS REGION.

There are many other veins in this Cowboy-Bonanza region, one of which, three miles southwest of the Bonanza vein, is traceable on the surface for a mile, with a width of from two to three and one-half feet.

THE RAINBOW VEIN.

The Rainbow vein, on Asphalt Creek, has been traced for two miles, with a reported width of from four to nine feet.

ESTIMATES OF TONNAGE.

As I have quoted from Mr. Eldridge's report as to the estimated possible tonnage of the gilsonite veins, it is due to him to quote his words explaining how he arrived at the figures:

> "In the case of the Cowboy, Bonanza, and Black Dragon veins, the basis upon which their contents have been estimated is, first, the dip of the inclosing strata, from three to seven degrees, in the same direction as the trend of the veins—that is, northwest; second, the disappearance of the veins in the underlying shales by splitting into scores of minute fissures; third, the maintenance of the veins along the surface through the many changes in the lithological character of the inclosing strata, suggesting that they may very probably extend through the same beds in depth, and with about the widths attained at the surface, until the underlying shales are encountered in their dip; fourth, the disappearance of the veins in the overlying shales to the northwest. In the case of the Black Dragon it is impossible to suggest the total depth attained by the fissure, for nowhere is its bottom visible. The estimate in the tables is based upon that portion which lies above the line of dip of the lowest stratum appearing at the southeasternmost exposure of the vein, and is probably considerably below the actual content."

Although, according to Mr. Eldridge, the limits of these hydrocarbon veins are pretty clearly defined, both as to depth, and along their course, this need not disturb anyone, as with a production of ten thousand tons a month, the tonnage as estimated will last for over two hundred and sixty years.

THE ELATERITE DISTRICT.

The area in which this so-called elaterite (more properly Wurtzilite) is found is in the region of Indian, Lake and Sams Canons, about fifty miles southwest of Ft. Duchesne, Utah.

Mr. Geo. H. Eldridge, in his report, says as follows:

"The mineral occurs in vertical veins from one to

twenty-two inches wide, twenty to two hundred feet high, and a maximum length of three and one quarter miles."

Under the head of "General Features," he also says:

"In the region under discussion perhaps thirty different veins of Wurtzilite were observed, but the number might easily be doubled, for they are adventitious in the extreme. Although their width and height are clearly visible, it is in nearly every instance impossible to estimate the length of the fissures because of the confinement of their outcrops to a vertical range of 200 feet in the faces of the cliffs, and their rare extension to the summits of the ridges. An exception of especial importance in this respect is a vein on the southeast side of the Left Hand Fork of Indian Canon, which, from having been cut at numerous points by side gulches, can be traced for a distance of 3¼ miles. A vein, also, on the northwest side of Lake Canyon, about 4½ miles above the upper lake, can be traced for a few hundred feet, though in width it is of slight importance. A vein in Jones' Hollow, an upper tributary of the Right Hand Fork of Indian Canyon, can be traced for barely 100 feet, though it may extend into the hill a considerable distance. Veins of narrower widths, from 2 to 6 inches, prevail; the maximum widths, 15 to 20 inches, are rare. The Wurtzilite veins end in length and depth by the gradual closing of the cracks; at the top, however, they are as frequently truncated as wedge-shaped. Locally, both at top and bottom they split into a number of small cracks, which quickly become mere joint planes."

I think, however, from the tonnage going out, and the accounts I have from reliable men who have seen the veins, that there are some a great deal wider than any described by Mr. Eldridge, and perhaps these have been opened up since he made his examination.

OIL.

While there are abundant evidences of oil from Yampa, Colorado, clear to Ft. Duchesne, Utah, with one or two

notable exceptions, no systematic exploitation work has been done, for the simple reason that no oil well is of any value, situated one hundred and twenty miles from a railway.

OIL WELL AT TRULL.

At Trull, Routt County, Colorado, on the Elk River, just above where it empties into the Yampa River, a well was sunk some years ago by the side of the road, and close to the bridge over the river. A reliable and well-informed citizen of Steamboat Springs happened to be in the vicinity, and a man came to him and told him oil had been struck in this well, and he then went to the spot, and saw the oil where it had flowed across the road. He told me of this, and also that the well was shut down that day, but the machinery has been kept in order, and a man being in charge since this occurred, some three years ago, we can form our own conclusions.

OIL WELL ON THE MILNER RANCH.

A well was also sunk on the Milner Ranch, a few miles below Trull, on the Yampa River, but with what results it is impossible to find out, as the greatest secrecy was observed. The machinery, however, is still in place.

RAVEN PARK OIL.

In Raven Park, near Rangely, Rio Blanco County, Colorado, however, more work has been done, and some actual results obtained, which are of great interest and importance, as regards the future of this great hydrocarbon country the Moffat Road is now entering.

In the Rangely field, the chief operator is The Requena Oil Company, the local manager being Mr. H. W. Walter, of Rangely, Colorado. He writes me under date of November 4, 1903, that their Requena well is now twenty-four hundred feet deep, with indications that they are about to drop into the oil sands.

Their Union Well No. 1, is down about fourteen hundred feet, and producing about twelve barrels per diem of seepage oil.

None of their wells have as yet reached the oil sands.

DESCRIPTION OF WELLS AND OIL.

There have been six test wells drilled at Rangely, and it is stated that none of them have as yet pierced the oil sands.

The quality of the crude oil is so fine that the people of Rangely burn it in their lamps, instead of buying refined oil. The drilling is cheap and easy, and they have water in one well only, which is stated to be surface water. In only two wells has casing been required.

This Rangely oil contains, as shown by analyses by the Standard Oil Company:

Naphtha	19.00
Illuminating Oil	60.00
Paraffine	20.00
Coke and Loss	1.00

Rangely oil has a specific gravity of 43.6 Beaume, as against 42 Beaume for highest quality of Pennsylvania and West Virginia oils.

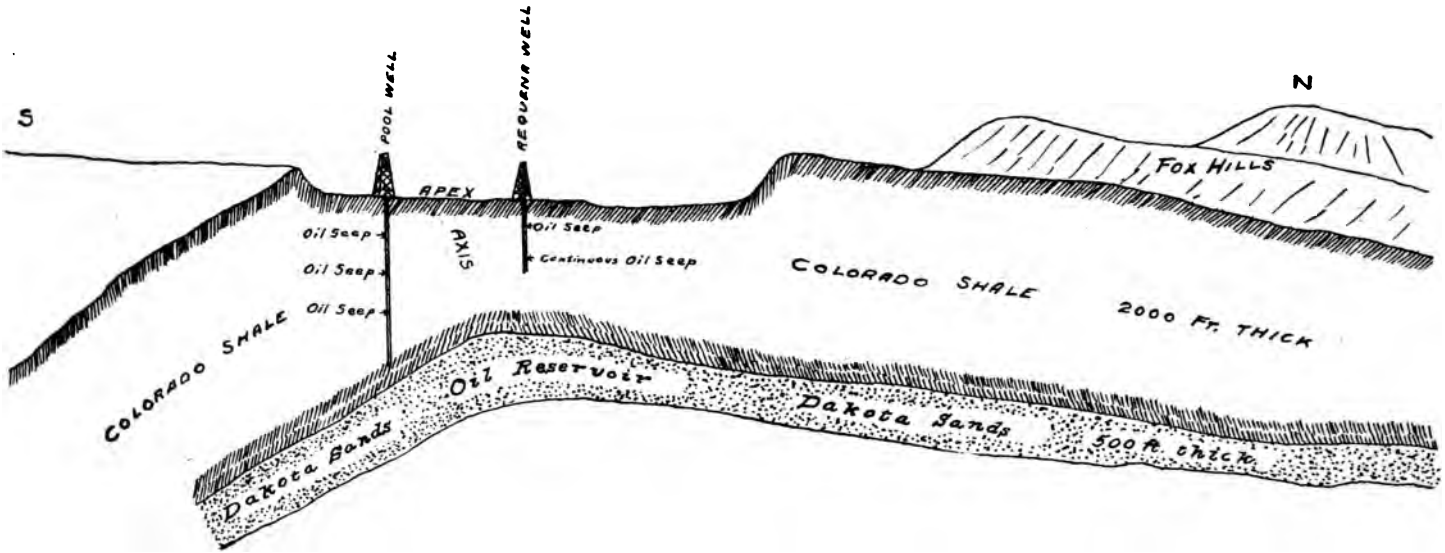
The cross-section of this oil field (see page 30) is pronounced by Prof. Arthur Lakes, who has made a special study of Colorado oil fields, to be approximately correct.

WHISKEY CREEK OIL SECTION.

About twenty miles southwest of Rangely is another oil section known as the Whiskey Creek District, where the evidences of oil are numerous and widespread; in fact, this particular oil basin is estimated at an area of about seventy square miles.

The strongest evidence of oil is an oil spring, which Prof. Lakes, who has reported on it, characterizes as the most powerful of its kind in Colorado, and from which he would argue for a large volume of oil as its source. Ten miles northeast of this spring similar oil was opened on the surface, but not in such a large volume. I give Prof. Lakes' own description of the spring, as published in Mines and Minerals of November, 1901:

> "This spring occurs at the head of a little ravine, intersecting a plateau of variegated red, lilac and green shales at the base of the tertiary series. The spring is easily found by the strong petroleum smell



CROSS-SECTION OF RANGELY, COLORADO, OIL FIELD.

pervading the air, as well as by the oil-soaked soil along the bottom of the ravine for one hundred yards or more leading up to the spring itself. The spring occurs in a zone of vertical fissures or shearage planes in a line of a fault and local disturbance in the variegated series of shales and sandstones. The main fissure has been enlarged by hand so that a man can just squeeze in and see a little pool of dark-green oil, which issues from the fissures at the bottom, together with a little water. The pool overflows and trickles down over the rock of the ravine, part is conveyed by a pipe to a rude board tank about six feet square and deep. The tank was about half full at the time of our visit, and showed upwards of one hundred gallons of oil of a dark olive-green cast floating on a certain amount of water. Oil and water also trickled down below the reservoir and impregnated, as they appeared to have done unrestrained for a very long period, the sandy soil and rock along the course of the ravine."

This oil field is about thirty miles from the projected line of the Moffat Road, but practically all down grade. No wells have been sunk as yet in this field that I can hear of. It is close to the gilsonite beds of Evacuation Creek, in Utah.

I have also heard of a big oil spring near White Rocks Indian Agency, north of Ft. Duchesne, Utah, on the reservation.

THE TOWN OF VERNAL.

The chief, or in fact the only, town in the center of the hydrocarbon field, is Vernal, Utah, a thriving, busy place of fifteen hundred inhabitants, situated in the middle of a fine agricultural valley, peopled by hard-working and prosperous Mormon farmers, the population of the Uintah Valley being about eight thousand, and these people are mainly in a radius of ten miles, known as the Ashley Valley. Vernal is an incorporated city of the third class.

It has a fine court house, which cost $15,000 (see photo, page 33); a school house, which cost $15,000 (see photo, page 32), and a Mormon tabernacle, in course of completion, to cost $30,000. There are also fine brick stores and

SCHOOL HOUSE, VERNAL, UTAH.

UINTAH COUNTY COURT HOUSE, VERNAL, UTAH.

ASPHALT SIDEWALK, VERNAL, UTAH.

residences, and many neat and comfortable homes, indicative of a thrifty and well-to-do people; in fact, it is by long odds the best town at present in existence between Denver and Salt Lake City on the line of the Denver, Northwestern and Pacific Railway, and I believe it will continue to be, as it has the country around it to make it and keep it so. The sidewalks and one block of the main street are laid with asphalt pavement. (See photo on page 34.)

DEPOSIT OF SAND ASPHALTUM.

This is mined from a deposit near the town of what is known as sand asphaltum. The outcrop of this deposit is twenty miles in length, and it lies flat, very much like coal, and will average six feet in thickness. For the sidewalks, the asphaltum was simply warmed in a vat or big kettle of hot water to make it soft, and then put down and rolled. It has been there for five years, and is today a perfect pavement. For the street, the asphaltum sandstone was simply broken up, raked, and the traffic afterwards pounded it down. Of course the surface is somewhat uneven, but it makes a fine street, and had it been rolled, would be smooth and excellent. I should add that as depth was gained on the vein, it got richer in asphaltum, and for the sidewalk one-half sand was added.

VERNAL COAL.

About seven miles northwest of Vernal is a seam of a very fair grade of bituminous coal, from which the residents of Vernal and the Ashley Valley get their fuel supply. The seam varies from four to six feet in thickness, and outcrops for a distance of about four miles. There are about thirteen claims on this seam with a considerable amount of development done on nearly all of them, varying from two to eight hundred feet of work each.

The Rich mine, from which I brought out samples, and which are now with the other coals in the basement of your offices, furnishes at present the greater part of the coal supply of Vernal. It is a free-burning coal of great heating power, and a fine domestic coal. The price of this coal delivered in Vernal is $3.00 per ton.

UINTAH VALLEY FREIGHT.

In addition to the outgoing and incoming freight connected with the hydrocarbons at the present time, may be mentioned the following:

WOOL.

Regarding the out-freight from the Uintah Basin and Vernal, two million pounds of wool can be reckoned on now from the Uintah Basin, and it is said it will not decrease in coming years. At one time this wool went to the Union Pacific Railway, at Green River, Wyoming, but Price, Utah, being the better route, has lately had this trade. Brown Park, north of Vernal, will shear about two hundred and fifty thousand pounds per annum, which now goes to the Union Pacific, but if the Denver, Northwestern and Pacific Railway were built, the sheep would be driven down, and shorn near the line. Of the two millions of pounds from the Uintah Basin, about half goes to Heber, Utah, some to Green River, Wyoming, and some to Price, Utah, but the Denver, Northwestern and Pacific would get it all.

SHEEP.

Thousands of mutton sheep were driven to the Union Pacific Railway last year, for shipment to Eastern markets, but I was informed that they had to be driven back again, as the Union Pacific could not furnish sufficient cars.

HONEY.

Three hundred tons of honey are shipped annually from Vernal to Price, on which a wagon freight of $15.00 per ton is paid.

Regarding incoming freight, there are now brought in from Price supplies for fifteen hundred confederated Ute Indians to the White Rocks and Ouray Agencies, the amount in tons I could not ascertain.

Government supplies for Ft. Duchesne, amounting to seven hundred and fifty thousand pounds per annum, are being shipped in from Price, Utah. At the time of my visit last April, there were two companies of infantry and

one troop of cavalry, in all about two hundred and fifty men.

At present all the in-freight comes from Price, Utah, on the Rio Grande Western Railway, by wagon, distance, Price to Vernal, one hundred and twenty miles.

AGRICULTURE.

At present, chiefly owing to the fact of the great distance from any railway, and its being in the Ute and Uncompahgre Indian Reservation, nothing has been done towards reclaiming the vast area of the Uintah Basin. But with the advent of the Moffat Road, and the opening of the reservations to public entry in October, 1904, all this will be changed. The soil is rich, the elevation only about five thousand feet, and sheltered on the north by the Uintah Range, whose snow-clad summits rise to thirteen thousand, seven hundred feet, and furnish abundant water for the valley below.

The Duchesne and Uintah Rivers, with their many tributaries, will, by ditches taken out from their heads, irrigate the whole valley, and transform it from a desert into one of the finest agricultural sections of the West. It will then raise tree fruits, sugar beets, hay, cereals of all kinds, small fruits, and every description of vegetable.

The farmers of the valley are far ahead of most of our Colorado ranchmen, who live so far from a railway. They build themselves nice houses, plant avenues of trees along their country roads (see photo, page 38), build school houses of brick in the country; their cattle are fat, and their lands well fenced and cultivated. Ashley Valley is sheltered on the north by the great Uintah Range, on the east by Blue Mountain, and on the west and south by a cedar ridge or range of low sandstone hills, in which outcrops the sandstone asphaltum vein before mentioned.

CONCLUSION.

There remains but little more to be said, and from the record contained in the preceding pages, it does not require a very fertile imagination to foresee the immense revenue that will accrue to The Denver, Northwestern and Pacific

AVENUE OF TREES ON COUNTRY ROAD, NEAR VERNAL, UTAH.

Railway, which will penetrate the Uintah Basin, not only from its hydrocarbon field, for purity and extent of gilsonite the largest in the known world, but also for its agricultural, pastoral, and industrial possibilities.

Yours truly,

W. WESTON,
Mining Engineer.

Denver, Colorado, December 7, 1903.

STATISTICS OF UINTAH COUNTY.

Number of acres of patented land	50,000
Number of acres new homesteads	60,000
Value of improvements	$500,000
Number of head of cattle	10,000
Number of head of sheep	85,000
Estimated wool clip for 1906, lbs.	600,000
Value of wool clip for 1906	$120,000
Number of colonies of bees	4,000
Output of honey (yearly average) lbs.	300,000
Acres in wheat	4,000
Yield of wheat, bushels	300,000
Alfalfa, acres	20,000
Yield of alfalfa, tons	60,000
Number of acres patented mineral land	10,500
Number of acres mineral land recorded, but not patented (estimated)	40,000
Incoming freight, supplies, etc., lbs.	3,000,000

ADDENDUM.

Since writing the foregoing report, the Uintah Railway has been built from Mack (formerly Crevasse), on the Rio Grande Western Railroad, to Dragon, a distance of fifty-five miles, and all shipments of gilsonite are now going out that way, instead of, as formerly, to Price, by the wagon road, which is now in disuse, and so badly out of repair as to be practically impassable. At the time I was there, the supplies for the troops at Ft. Duchesne were also coming in by this route from Price, but now these also come in under contract with the Uintah Railway.

At present, therefore, the only gilsonite veins which are shipping are the Dragon and those in the immediate vicinity, all of which are said to be owned by the same people who built and own the above railway. With the advent of the Denver, Northwestern and Pacific Railway into the Duchesne Valley, however, or a road now projected by Jesse Knight and Sen. Reed Smoot, of Provo, Utah, from Provo to meet the "Moffat Road" at Jensen, on Green River, and the Colorado State line, all the Northern gilsonite veins in the vicinity of Ft. Duchesne and Pariette will be worked again as independent shippers, and will then be able to market their product at reasonable rates for freight.

The Indian Reservation was opened in 1905, and the country is settling up, but very slowly, owing to the lack of transportation facilities.

Regarding the Willow Creek hydrocarbon deposit, in Grand County, Colorado, on analysis this product proves to be grahamite, and not gilsonite, and is worth about $20 per ton in Denver. It has not been worked since I made my report, owing to litigation over the title, but this is now about to be brought to a close.

The approximate annual consumption of gilsonite in the United States is now about 8,000 to 10,000 tons, and the consumption continues to increase each year—during the last year particularly so—owing to the reduced price at which gilsonite is being sold. At this writing the freight from Dragon to New York is $23.35, which includes the $10 haul charged by the Uintah Railway.

In the oil field, there is nothing doing, and little change has taken place. Some desultory work has been done, and many of the ownerships have been consolidated, but it is not likely that any vigorous further exploitation work will be done until the advent of the "Moffat Road," the grade of which is now about 130 miles distant.

W. WESTON.

October 1st, 1907.